Study of Land Criticality in Sub-Sub Das Amandit South Kalimantan

Muhammad Ruslan[1], AbdiFithria[2], Setia Budi Peran[3], Syam'ani[4]

Faculty of Forestry,LambungMangkurat University,
INDONESIA.

[1]ruslan2702@yahoo.com, [2]abdifithriasylva9999@gmail.com,
[3]budiperan@yahoo.co.id, [4]syamani.borne@gmail.com

ABSTRACT

Critical land is defined as a land that has been damaged and is not in accordance with its allocation, thus losing or diminishing its functionality to specified or expected limit. Critical land is a land that has less than 25% of vegetation covering, topography with a slope of more than 15% and/or characterized by symptoms of erosion such as sheet erosion (erosilembaran) and gully erosion (erosiparit) (Ministry of Forestry, 1994). The land used is not in accordance with the land capability, making it have or be in the process of physical/chemical/biological damage, which in turn endangers the hydrology function, agricultural production, resettlement and socio-economic life of people in the watershed.

The purpose of this study is to identify the critical level of land on each land unit and land covering based on biophysical parameter analysis in Sub-Sub-watershed Amandit. The benefit attained from this study is expected to find the criticality level of land based on biophysical characteristics of land in Sub-Sub DAS Amandit South Kalimantan.

The results of the analysis showed that the widest area with the most critical level of degradation is actually found in Protected Areas, within over 9,000 hectares. It is followed by Kentawan Mountain Nature Reserve covering an area of over 200 hectares. Very critical land is only found on Protected Forest, although only covering 127.58 hectares. There is very little non-critical land in Sub-sub-watershed Amandit, with 20.51 hectares, which is also only in Protected Forest. This non-critical land is a flat forested area in Protected Forest region. The extent of critical land in the Protected Forest Region is determined by its steep topography, and most of the area actually covered by Shrublands. While critical land on Kentawan Mountains Nature Reserve, in addition to topography, is also determined by the condition of the rocky land, so that no crops that can grow on it.

Keywords: Critical land, erosion, watershed, Amandit, South Kalimantan

INTRODUCTION

The land and forest degradation in Indonesia nowadays has become a major concern to many people, both nationally and internationally. Based on the interpretation of *Badan Planologi Kehutanan*in 2003, the indicative target of *Rehabilitasi Hutandan Lahan* (RHL) is about 100.7 million ha with the forest and land degradation rate reached 2.83 million ha/yearthat occurred on various functions and types of forest formations. To overcome that problem, efforts to recover and improve the functionality and productivity of forest and land are needed, one of which is through forest and land rehabilitation or *Rehabilitasi Hutandan Lahan* (RHL).

The activity of forest and land rehabilitation would yield optimum effects if the management pattern is based on a*Daerah AliranSungai*(DAS) or watershed unit, because the effects of human resources interaction with their environment do not go by the political borders, as they

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flow through the natural border of DAS instead. Therefore, the activities carried out in the upstream would influence significantly to the middle stream and downstream.

In planning the activities of *Rehabilitasi Hutandan Lahan*in a watershed,it is important to notice some aspects of environment and human resources, such as biophysical and socio-economic and cultural aspects of local people. Biophysical aspect is based on the main problem that has been or is still occurring (for example flood, erosion, sedimentation in rainy season and drought in dry season) and the land criticality level. From the socio-economic and cultural aspect of the people, several indicators should be noted, including the dependency level of people to the land (both for general agriculture and resettlement), the farmers' adoption level to the new technology, conservation and the institutional existence and activities to support dry land agriculture (*Direktur Jenderal Reboisasi Rehabilitasi Hutandan Lahan Departemen Kehutanan RI, 1998*).

Critical land is defined as a land that has been damaged and is not in accordance with its allocation, thus losing or diminishing its functionality to specified or expected limit. Critical land is a land that has less than 25% of vegetation covering, topography with a slope of more than 15% and/or characterized by symptoms of erosion such as sheet erosion (*erosilembaran*) and gully erosion (*erosiparit*) (Ministry of Forestry, 1994).The land used is not in accordance with the land capability, making it have or be in the process of physical/chemical/biological damage, which in turn endangers the hydrology function, agricultural production, resettlement and socio-economic life of people in the watershed (Ministry of Forestry, 2001).

Erosion is a phenomenon of the movement or transportation of soil or parts of the land from one place to another via natural media, specifically water and wind (Arsyad, 1989), while the definition of erosion according to Kartasapoetradan Sutedjo (1985), erosion that can also be called land scraping or sliding, in fact is a process of washing outthe soil by the pressure or power of water and wind, both naturally or as a result of human actions/behaviors.

One equation first developed to learn erosion of the soil is called Musgrave equation, which was later developed into a famous equation still being used until now, called Universal Soil Loss Equation (USLE) proposed by Wischmeierdan Smith (1978). This equation enables the planner to predict the average soil erosion rate in a particular land within a slope with a certain rainfall pattern for every type of soil and the implementation of land management (land conservation action). USLE was developed to predict long-term erosion of sheet erosion and gully erosion under certain conditions.

PURPOSE AND BENEFIT

In general, this research is aimed to provide references for the planners and policy makers in determining priorities of forest and land rehabilitation based on the land criticality of a watershed, in order to support the implementation of *Gerakan Nasional-Rehabilitasi Hutandan Lahan* (GN-RHL)/*Gerhan*activities. Specifically, the purpose of this study is to identify the critical level of land on each land unit and land covering based on biophysical parameter analysis. The benefit attained from this study is expected to find the criticality level of land based on biophysical characteristics of land in Sub-Sub DAS Amandit South Kalimantan.

METHOD

This research was conducted in all areas of Sub-sub DAS Amandit, Sub DAS Negara, DAS Barito, South Kalimantan Province. The time required for this research is 8 (eight) months

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starting from the early March until the end of December 2014 from data gathering, data processing, until the preparation of research report.

The spatial analysis of land criticality method used in this research referred to *Peraturan Direktur Jenderal Bina Pengelolaan Daerah Aliran Sungai dan Perhutanan Sosial No: P. 4/V-SET/2013*, about *Petunjuk Teknis Penyusunan Data Spasial Lahan Kritis*. In this method, the studied area is divided into three regions, namely *Kawasan Hutan Lindung* (protected forest region), *KawasanBudidayaPertanian*(agricultural cultivation region), and *Kawasan Lindung di Luar Kawasan Hutan* (protected region outside forest). In this research, the data of Protected Forest Region and Agricultural Cultivation Region referred to the spatial data of Forest Regions of South Kalimantan Province enclosed in *LampiranSuratKeputusan Kementerian KehutananRepublik Indonesia Nomor 435/Menhut-II/2009, tanggal 23 Juli 2009*. Protected Region Outside Forest, which include sriver borders, creeks and lakes, is ignored. Spatial analysis method in this research is fully conducted using *ESRI ArcGIS 10.3 for Desktop* software.

Table 1.Forest Regions of Sub-sub DAS Amandit

No.	*Region FunctionAccording to SK. Menhut No. 435 2009*	*Information*	*Analysis Unit*	*Area Size (Hectare)*
1	APL	Other Usage Area	APL and Cultivation Region	81.700,80
2	HL	Protected Forest	Protected Region	23.590,50
3	HP	Production Forest	APL and Cultivation Region	12.345,60
4	RiamKanan	Protected RegionLake Bangkau	Protected Region	42,80
5	SA	Natural ReserveMount Kentawan	Protected Region	240,43
	Total Area of Sub-sub DAS Amandit			*117.920,14*

*Peraturan Dirjen BPDAS-PS No. P. 4/V-SET/2013*required several spatial parameters in spatial modeling to determine critical land. These parameters are land covering, slope, erosion danger level or *Tingkat Bahaya Erosi* (TBE), land productivity and management. In this case, land covering is only used in *Kawasan Hutan Lindung*, while land productivity is only used in *Kawasan Budidaya Pertanian*. One major parameter in spatial data extraction of land criticality is *Tingkat Bahaya Erosi* (TBE). This TBE data is gathered by classifying the amount of loss (soil erosion) in ton per hectare per year within a catchment area. The data about amount of erosion is gathered by using *Universal Soil Loss Equation* (USLE). USLE equation itself used several parameters, such as rainfall, slope tilt and length,type of soil (erodibility factor), land covering, and conservation action. In this research, it is assumed that there is no previous conservation action performed in all of Sub-sub DAS Amandit regions, and the amount of rainfall in all of Sub-sub DAS Amandit regions is assumed to be the same.

The empirical model of the USLE equation is written as follows:

$A = R.K.L.S.C.P.\ 0{,}61$ Where:

A = The amount of eroded soil per area unit per time unit, stated in accordance with K unit and R period chosen, in practice the unit used is ton/ha/year.

R = Rain erosivity and surface flow factor, or the amount of rainfall erosion index unit, as a result of multiplication of total rain energy (E) and rain intensity of maximum 30 minutes (I30), annually in KJ/Ha

K = Soil erodibility factor, or the rate of erosion per rain erosion index (R) of soil gathered from experiment plot with 22,13 m length and tilt uniformity of 9% without plant, in ton/KJ unit.

L = Slope length factor, or the ratio between the amount of erosion per index of erosion of a land in standard length (m).

S = Slope tilt factor, or the ration between the amount of erosion per index of erosion of a land with standard slope, L and S are combined into LS factor.

C = Land covering plants and plant management factor, or the ratio between the amount of erosion of a land with certain plant covering and plant management with an identical land without plant, no dimension.

P = Practical conservation action factor, or the ratio between the amount of erosion per erosion index with the practical conservation action and the amount of erosion from a land gathered along the slope in identical conditions, no dimension.

0,61 = Correction factor (Ruslan, 1992).

RESULTS AND DISCUSSIONS

Sub-sub DAS Amandit has various land topography characters. From the heights spread from Meratus Mountains to the valleys of Barito River, the terrain slope class ranging from very steep to flat, and the land formation from mountainous to sloping or flat. These heterogeneous topography characteristics may cause landscape variation in Sub-sub DAS Amandit to be very large, thus considered to represent majority of characteristics of landscape in South Kalimantan Province. The heterogeneous variation of landscape character may cause difference of influence to the land criticality level on each part of Sub-sub DAS Amandit. Picture 1 and Table 2 below indicate the diversion of land criticality level of Sub-sub DAS Amandit.

Table 2. Land Criticality Level of Sub-sub DAS Amandit PerRegion

No.	*Region*	*Criticality Level*	*Area Size (Hectare)*
1	Other Usage Region	RatherCritical	7920,52
		Critical	2,54
		Potentially Critical	71424
2	Protected Forest	RatherCritical	8425,05
		Critical	9987,21
		Potentially Critical	4977,29
		Very Critical	127,58
		Not Critical	20,51
3	Production Forest	Rather Critical	5658,47
		Potentially Critical	6651,07
4	Protected Region Lake Bangkau	Potentially Critical	10,08
5	Natural Reserve Mount Kentawan	Rather Critical	17,3
		Critical	220,77

Information: Body of water area is excluded

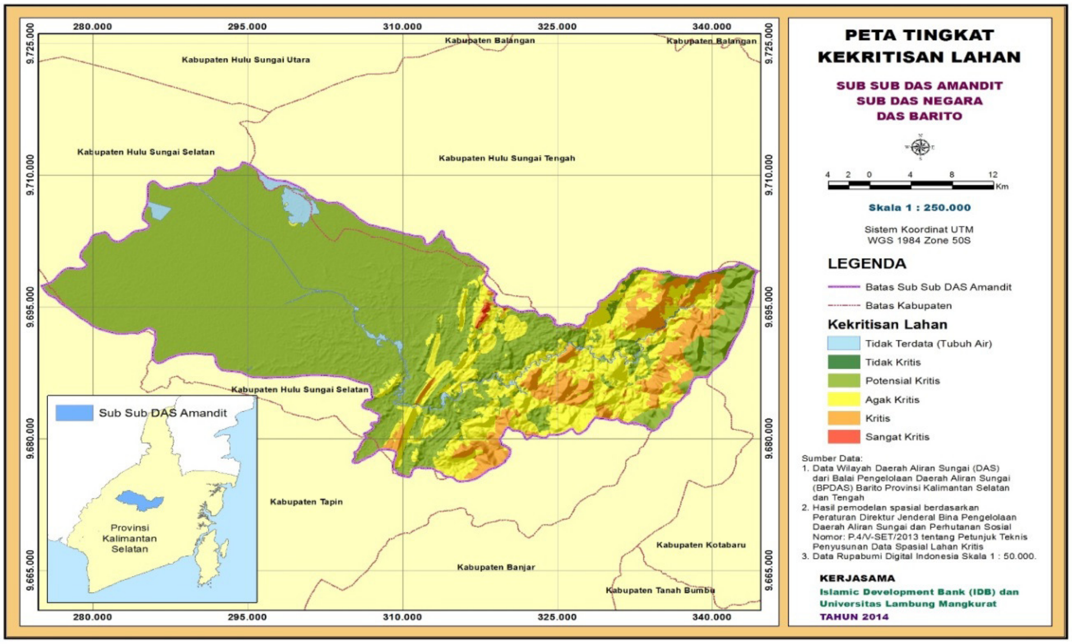

Figure 1.The Map of Land Criticality Level of Sub-sub DAS Amandit

The result of land criticality level analysis indicated that the widest area of critical land was in fact found in Protected Forest, with more than 9.000 hectares, followed by Natural Reserve Mount Kentawan with more than 200 hectares. Very critical land is only found in Protected Forest, although it is only about 127,58 hectares. There is very little non-critical land in di Sub-sub DAS Amandit, with 20,51hectares that is also only found in Hutan Lindung. This non-critical land is flat forested area in Protected Forest Region. The amount of critical land in Protected Forest Region is more determined by its steep topography, and most of its area is covered by shrubs. Critical land in Natural Reserve MountKentawan, besides by its topography, is also determined by its stony land condition, which makes no hard plant can grow on top of it.

The upstream part that is also the highest elevation in Sub-sub DAS Amandit is potentially critical land, comprising area of more than 4.000 hectares. This part is a region with very steep topography and still densely covered with forest. If one day the forest covering is no longer exist, it is very possible for this area to be very critical. Therefore, the future conservation action should be more addressed to reforestation activities. Critical, rather critical, and potentially critical areas in the upstream part of Sub-sub DAS Amanditare located outside Protected Forest, where in addition to greening, mechanical conservation such as terracing can be considered.

Similar to the upstream of Sub-Sub DAS Amandit, the downstream part of Sub-Sub DAS Amanditis also potentially critical area, but it has different characteristics. This area is flat, but mostly covered by shrubs, with alluvial soil, which is susceptible to erosion. Because this area is flat, mechanical conservation is not possible. Like the upstream area of Sub-Sub DAS Amandit, the conservation action at this downstream area is more directed to protecting the vegetation covering, and greening its open areas.

At the downstream part of Sub-sub DAS Amandit there is also a protected region with within a small area, namely Protected Region Lake Bangkau. Overall, this protected region is potentially critical. Similar with other surrounding regions, the critical land potential in

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LakeBangkau is more determined by its shrubs land covering factor, and its erosion-susceptible, alluvialsoil. Since LakeBangkal is located in the middle of the marsh, the conservation effort that can be conducted is making some kind of protected border area within a certain radius from LakeBangkau. In the future, this border area can be considered to convert into wetlands forest.

CONCLUSION

1. Critical land in Sub-sub DAS Amandit is mostly located in the upstream area, which is included in Protected Forest Region and Production Forest Region. This is because the area has steep topography and mostly covered with Shrubs.
2. Most of the land at the downstream of Sub-sub DAS Amandit that is included in Other Usage Areais potentially critical. The potentially critical land in this downstream area is mostly determined by soil type and land covering factors.
3. The possible conservation action for Protected Forest area at the upstream of Sub-sub DAS Amandit is reforestation, while for areas outside Protected Forest at the upstream of Sub-sub DAS Amandit are terracing dan greening.
4. The possible conservation action for the downstream of Sub-sub DAS Amandit is protecting its vegetation covering on top of the soil, while doing greening at the open areas.

SUGGESTION

This research is limited to only obtaining spatial data of critical land in Sub-sub DAS Amandit, while the recommended practical effort to handle already critical or potentially critical lands is not covered. In the future, the continuation of this research, especially on how to handle those already critical or potentially critical lands needs to be considered.

ACKNOWLEDGEMENT

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APPENDIX

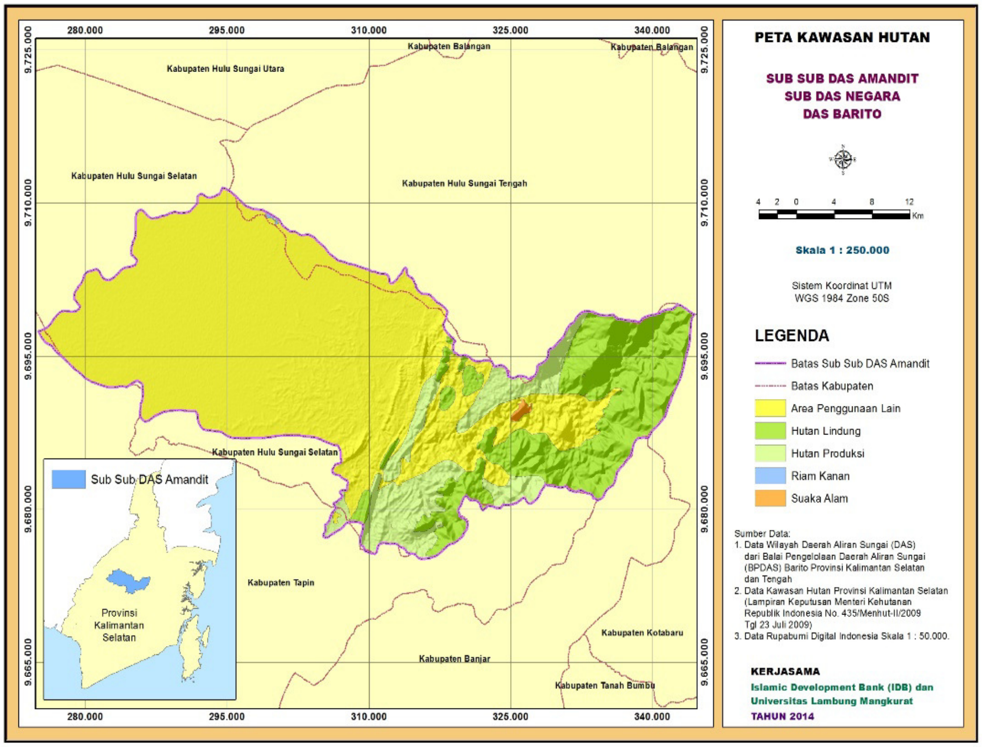

Figure 2. Map of Forest Regions inSub-Sub DAS Amandit

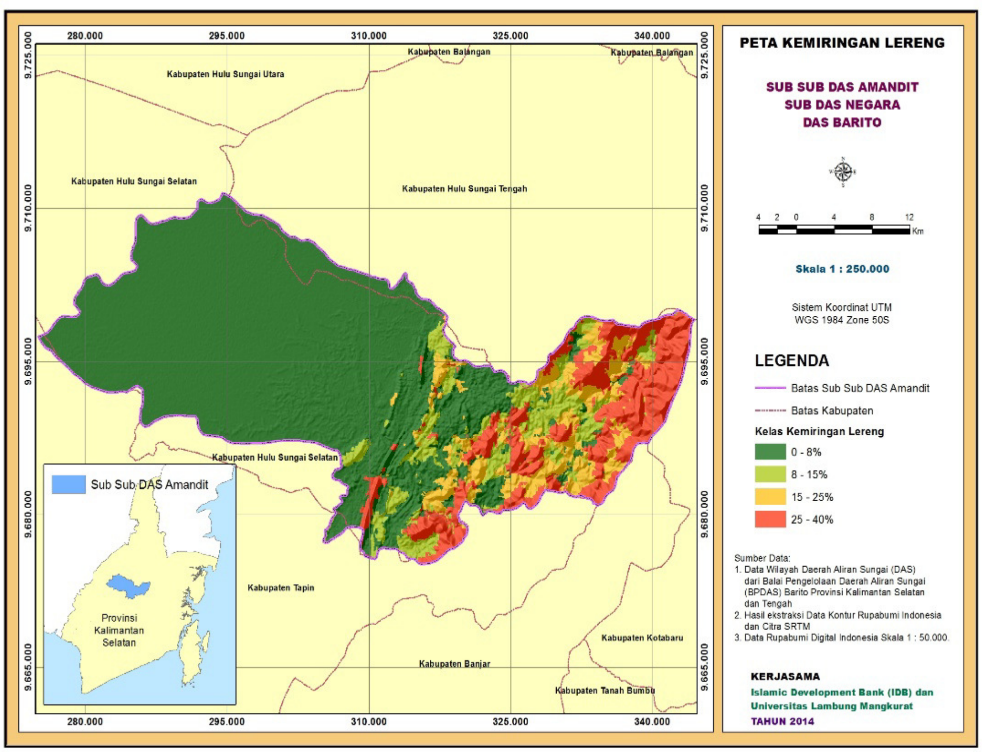

Figure 3. Map of Slope Tilt Class in Sub-Sub DAS Amandit

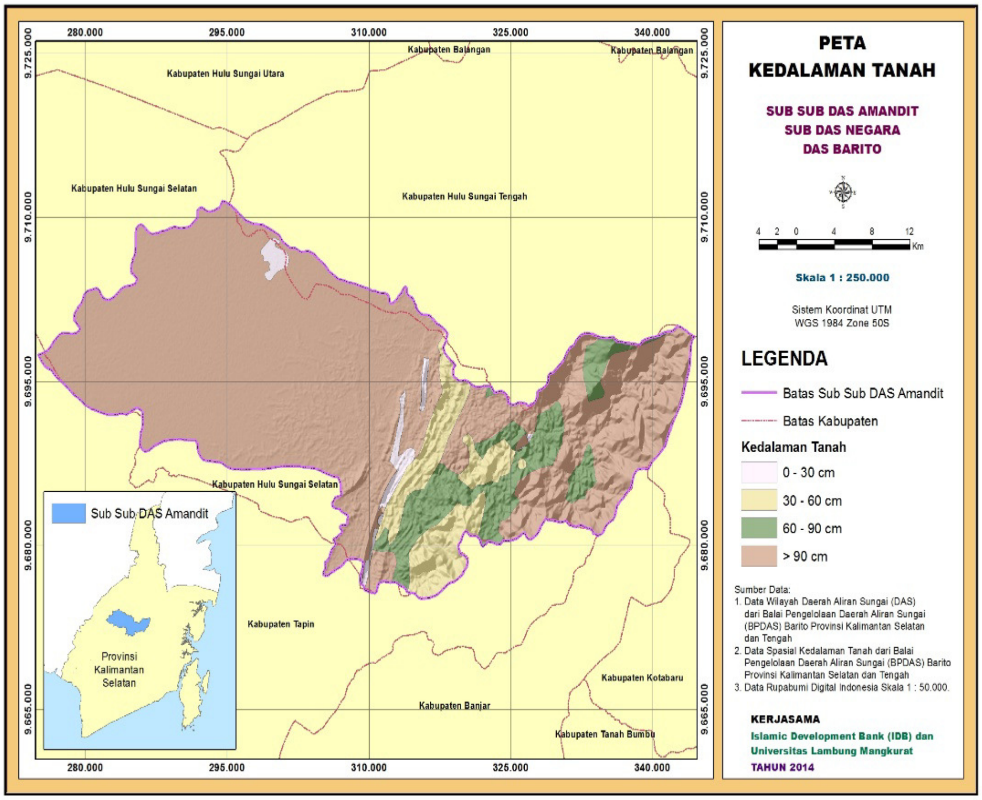

Figure 4. Map of Soil Depth in Sub-Sub DAS Amandit

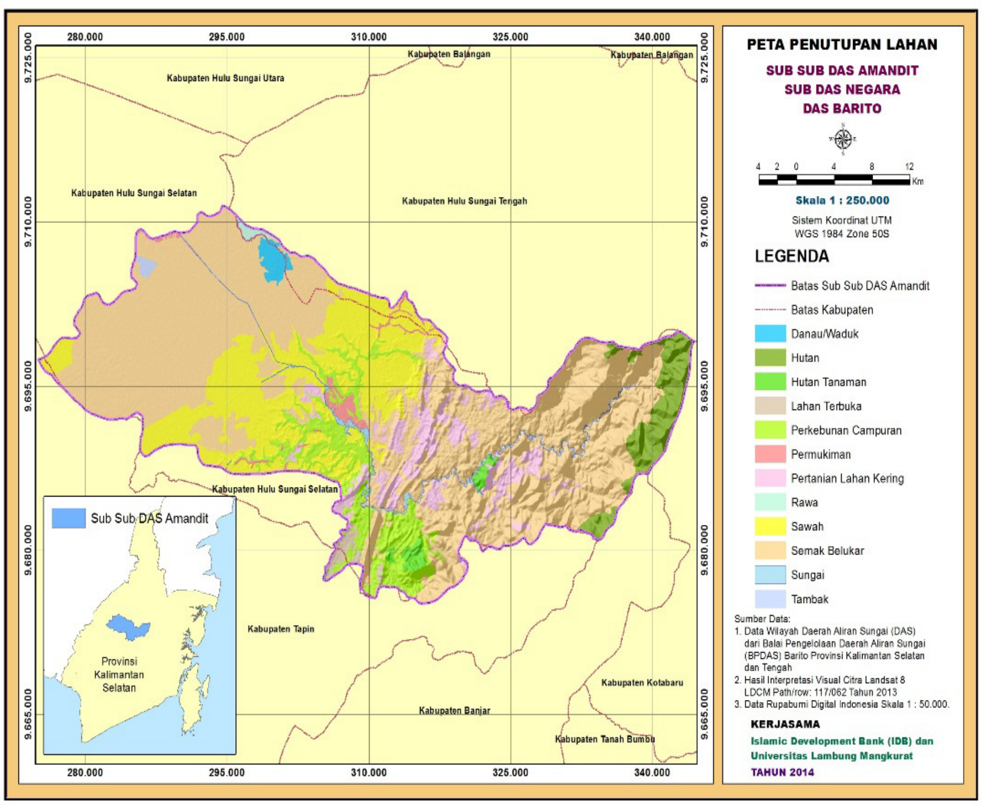

Figure 5. Map of Land Covering inSub-Sub DAS Amandit

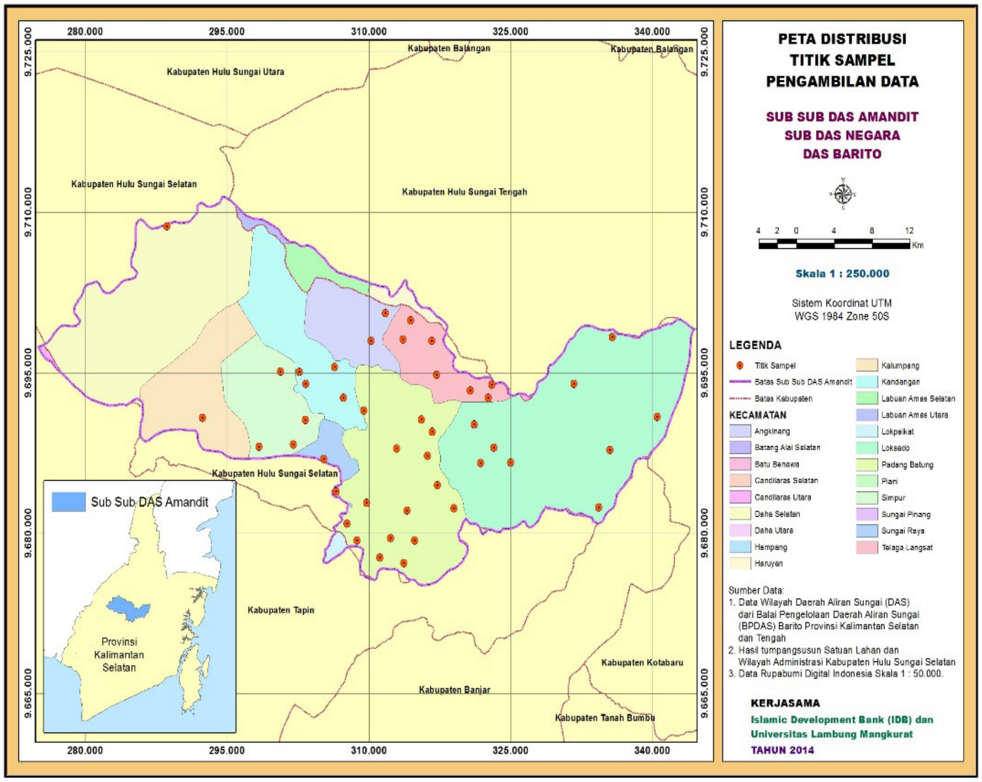

Figure 6. Map of Research Sampling Points Distribution PetaDistribusi in Sub-Sub DAS Amandit

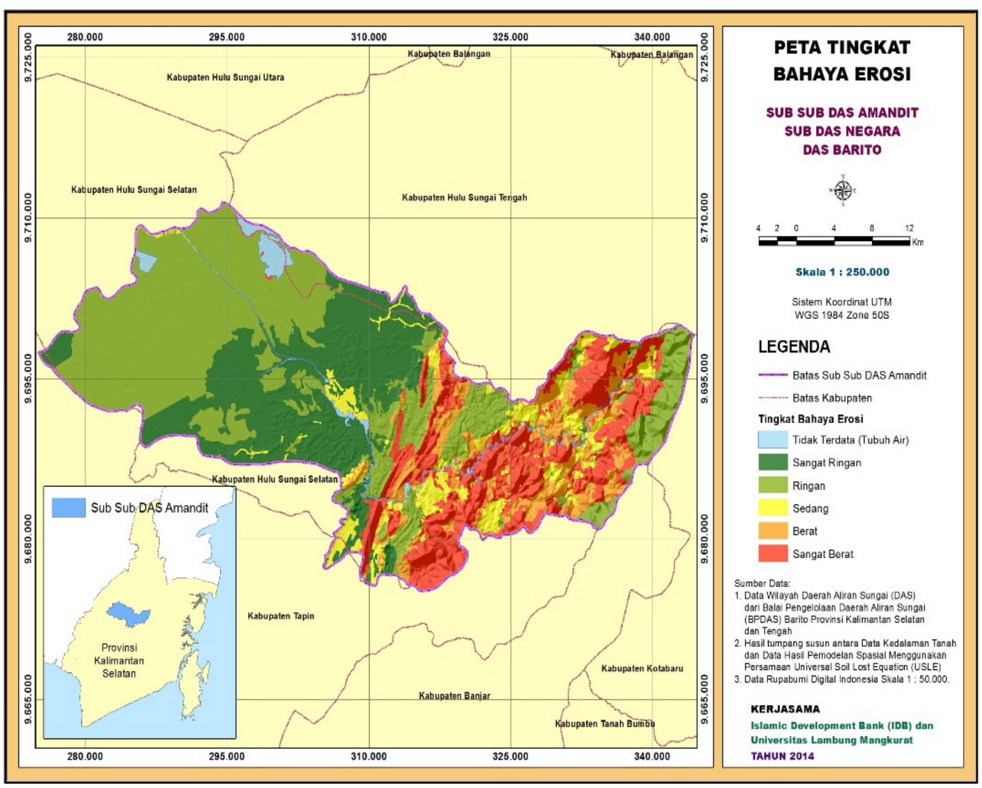

Figure 7. Map of Erosion Danger Level in Sub-Sub DAS Amandit